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D scription

The present invention relates to a cutting tool having a throw away insert and its holder for use in deep grooving, cut-off machining, or the like according to the precharacterizing portion of claim 1.

A cutting tool for the abovesaid purposes is known which is comprised of a throw away insert and its holder so as to permit repeated use of the holder. Such a cutting tool is disclosed e.g. in Japanese Unexamined Patent Publication No. 57-156124, corresponding to EP-A-0059602.

The holder of such a tool has to hold a very small throw away insert. The size of the insert makes it impractical to use a known clamping mechanism such as a clamping block. Instead, the holder is formed with upper and lower jaws to define a wedge groove therebetween, whereas the throw away insert is formed with a wedge portion at an end opposite to its cutting edge so as to be elastically held between the upper and lower jaws of the holder by elasticity of the material of the holder.

This type of conventional cutting tool has the entire holder made of a special steel. If the tool is used to cut a narrow groove, the dimension of the holder in the direction of the width of the groove has to be accordingly small. This will lower the rigidity of the tool, thus increasing the tendency to chatter.

Further, since the holder is made of a special steel in spite of the fact that its widthwise dimension is limited, the wedge groove tends to open or widen when subjected to the cutting force, allowing the insert to retract and the cutting edge to get out of position. This impairs the machining accuracy. In an extreme case, machining might be interrupted.

Furthermore, the insert supporting portion of the holder can be worn out rapidly with repeated use, thus worsening the stability in holding the insert. Thus the tool life will be shortened.

Also, since the holder is made of steel, its vibration resistance is rather poor. This makes it impossible to increase the feed speed and to improve the machining efficiency and will limit the overhang of the holder from the fixture and thus the diameter of the bar to be cut off and the depth of groove to be machined.

Further developments of cutting tools are disclosed in "Werkstatt und Betrieb", volume 111, No. 5, 1978, PP297-303, wherein it is disposed to use an minimun wedge angel of 11° to 22,5°. However, this wedge angle is related to the frictional force between the materials of the throw away insert and the holder, respectively, and gives no suggestion for improving the holder with respect to the probl ms inherent with steel holders.

It is therefore an object of the invention to provide a cutting tool with throw away insert having high machining accuracy and a long life time.

This object is achi v d by a cutting tool having a holder body formed with a wedge groove and a throw away insert having a cutting edge at one end thereof and a wedge portion at an end opposit to said cutting edge, said wedge portion being adapted to be clamped in said wedge groove by elasticity of the material of said holder so that the principal component of the cutting force will be received on a first of two wedge surfaces of said wedge groove and its backside component will be received on the second one, therein said wedge groove has a curved back end face out of contact with said throw away insert received therein and wherein one of said wedge grovve of said holder or of said wedge portion of said throw away insert has its wedge surface relating to the principal component formed with an axial ridge in V-shape whereas the other has its wedge surface relating to the principal component formed with an axial groove in V-shape, wherein the wedge angle between said wedge surfaces is in the range of 6° to 14°, characterized in that said holder body is made of cemented carbide, that said back end surface is curved with a radius R1 at a portion connected with said second wedge surface of said wedge groove and with a radius R2 at a portion connected with said first wedge surface, wherein R2 is greater than R1, and that said ridge having its top cut away so as to contact said axial, V-shaped groove along parallel lines which are apart from each other by a distance a, said distance a being determined by

$$a \leqq 0.4W,$$

wherein W is the width of the cutting edge of said insert.

Another feature of the present invention is that the radii R1 and R2 being determined as

$$0.2 \leqq R1 \leqq 5$$
$$1 \leqq R2 \leqq 10.$$

A further feature of the present invention is that the groove and ridge at the side relating to the principal component of cutting force having angles of θ_4 and θ_3, respectively, which are determined as

$$3° \leqq \theta_4 - \theta_3.$$

Other features and objects of the present invention will become apparent from the following description taken with reference to the accompanying drawings, in which :

Fig. 1 is a side view of the first embodiment ;

Figs. 2 to 4 are side views of the fourth to seventh embodiments showing a portion of the holders ;

Fig. 5 is a side view of the eighth embodiment ;

Fig. 6 is a partially cutaway side view of the holder of the nineth embodiment ;

Fig. 7 is a persp ctive view of the tenth embodiment with the insert removed from th holder ;

Fig. 8 is a s ctional view of th w dge portion of the throw away insert of the same ;

Fig. 9 is a front vi w of the same in use ;

Fig. 10A is a schematic view showing the ar-

rangement for testing the holding power of the holder ;

Fig. 10B is a graph showing the results of a comparison test for the holding pow r of th holder ;

Fig. 11 is a side view of the eleventh embodiment;

Fig. 12 is a graph showing stress values at the deep end face of the wedge groove of the specimens, the configurations of which are shown in the drawing ;

Fig. 13 is a view showing the state of holders with different R1 and R2 values after their use ;

Fig. 14 is a sectional view of the twelfth embodiment showing the insert and the holder in engagement ;

Fig. 15 is a perspective view of the entire tool of the same ;

Fig. 16 is a sectional view of a prior art tool similar to Fig. 14 ;

Fig. 17A is a side view showing the points analyzed in the FEM analysis ;

Figs. 17B to 17E are views showing the results of analysis ;

Fig. 18 is an analytic view obtained by the FEM showing how the contact portions displace ; and

Fig. 19 is a view showing the results of cutting experiments with tools having different width values a and various differences of angle θ.

Now referring to Fig.1 which shows the first embodiment of a holder body 1 made entirely of cemented carbide with a wedge groove formed in the insert supporting portion 1a.

A throw away insert 10 has a cutting edge 11 and a wedge portion 12 at rear end thereof to be press-fit in the wedge groove 2 so as to be fixedly sealed in the groove. The principal component of the force which acts on the insert during cutting is received on one side 3 of the groove, whereas its backside component is received on the other side 4 thereof.

The holder 1 usually has its top and bottom surfaces 1c and 1d gripped tightly by a clamping means (not shown) so as to be held in a fixed position. The holder is gripped so hard that its gripped surface might chip if it is made of cemented carbide.

Further, in order to prevent the insert 10 from shifting sideways, the wedge portion 12 may have its top and bottom surfaces 14 and 13 axially grooved or ridged whereas the wedge groove 2 has its top and bottom surfaces 4 and 3 ridged or grooved so as to be complimentary in sectional shape with the surfaces 14 and 13 so that the insert 10 will not be restrained from moving in its press-fit direction. Further, if such grooved and ridged surfaces hav a V-shaped section, they will serve not only to prev nt th insert from shifting sideways but also give the insert a widthwise centripetal pull. The holder body 1 may be formed with w dge grooves 2 at both nds ther of.

Th tool shown in Fig. 2 is a modification of th tools shown in Fig. 1. The holder 1 has its top and bottom portions 5 mad of steel in ord r to pr vent th surfaces to be clamped from chipping and to minimiz its production cost. The c ntral portion including the insert supporting portion is made of cemented carbide to obtain a high rigidity and to protect the portion formed with the wedge groove 2 against deformation and wear.

The tool shown in Fig. 3 has the holder 1 made of two different kinds of cemented carbides. Namely, one end portion 1a is made of a comparatively hard cemented carbide for high wear resistance at this portion whereas the other portion 1b bonded to the end portion 1a is made of a cemented carbide which has a higher toughness than the cemented carbide forming the end portion 1a. As a whole, the holder has a rigidity substantially equal to that of the tool shown in Fig. 3 and has its surfaces to be clamped sufficiently protected from getting chipped.

One advantage of making at least the insert supporting portion of the holder of cemented carbide is that the jaw portions formed over and under the wedge groove 2 are less likely to deform because of high Young's modulus of cemented carbide. Thus the jaw portions will effectively check the insert from with drawing. But this tool has one drawback that the gripping force will be less.

Fig. 4 shows a tool which is free from this problem. In this embodiment, layers 6 made of a soft metal such as nickel, chrome, copper or cobalt are plated on the surfaces 3 and 4 of the wedge groove 2. The layers 6 are adapted to elastically deform to increase the frictional resistance with the insert 10 so that it will not fall off the front end of the holder. The thickness of the layers 6 should be within the range of 2-1000 microns, preferably 5-500 microns. If the layers 6 are too thin, the frictional resistance will not increase sufficiently to hold the insert tightly. If they are too thick, the effects of making the insert supporting portion from cemented carbide will be lost.

The wedge groove 2 shown in Fig. 1 should preferably have a first wedge angle θ1 of 0-15 degrees (which is the inclination of the surface 3 with respect to the horizontal plane) and a second wedge angle θ2 of 6-14 degrees (which is the inclination between the surfaces 3 and 4) in view of the characteristics of cemented carbide.

Cemented carbide is four to five times harder than steel and thus has an excellent wear resistance. According to the present invention, cemented carbide is used to minimize the wear on the surfaces of the wedge groove for receiving a throw away insert and to hold the insert tight. Especially, the front end corner of the upper jaw is l ss liable to w ar during cutting. The tool is thus assured of a longer service life.

Also, since the Young's modulus of cem nted carbide is two to three times higher than steel, the tool is less likely to deform and the w dge groov is

restrained from opening. Thus, th insert can b rigidly and stably held in the wedge groov . As a result, a workpiece can be machined mor accurately. Nondeformability of the holder due to higher ridigity will enable the workpiece to be fed faster and allow the holder to be clamped with a larger overhang from the fixture without the fear of chattering during cutting. This will make it possible to use the tool for more extensive applications under less limited conditions.

Fig. 5 shows the eighth embodiment in which the surfaces 3 and 4 of the wedge groove 2 are formed of a harder material than that of the holder body 1. Though in this embodiment chips 6 of cemented carbide are joined to the holder body 1 of steel by brazing or the like to form the hardened surfaces 3 and 4, the surfaces may be hardened in any other way. For example, as shown in Fig 9, the holder body 1 of steel may have its wedge groove surfaces coated with layers 6 of a hard material such as TiN or TiC. The thickness of the covering layer should be about 3-10 microns.

The surfaces 3 and 4 of the wedge groove formed of a hard material are highly resistant to wear and the tool can be used stably for a longer time without wear.

The tool shown in Figs. 6 to 8 includes a holder 1 having its insert supporting portion (i.e. its head formed with a wedge groove 2) formed of cemented carbide. The wedge groove 2 is formed with wedge surfaces 3 and 4.

As shown in Fig. 9, an insert 10 has its top and bottom surfaces 13, 14 coated with soft metal layers 15 made of a soft metal such as nickel, chrome, copper, cobalt or their alloy. The layers have to be provided at least partially on wedge surfaces 13 and 14 so as to increase the friction with the wedge surfaces 3 and 4. The layers should have a thickness of 2-1000 microns and preferably 5-30 microns from an economical viewpoint. If the layers are too thin, its frictional force would not increase sufficiently and if they are too thick, the expected effects of the cemented carbide holder will be lost.

The insert 10 of Fig. 7 is provided in its top rake face with a chip breaker groove 16. A breaker projection may be provided instead of the breaker groove.

In view of the characteristics of cemented carbide, the wedge groove 2 should preferably have a first wedge angle θ_1 of 0-5 degrees (which is the angle of the surface 3 with respect to the horizontal plane) and a second wedge angle θ_2 of 6-14 degrees (which is the actual wedge angle of the groove 2 between the surfaces 3 and 4).

Th holder 1 of Fig. 7 should have its top and bottom surfaces 17,18 wedge-shaped so as to b pressed at its one side against a reference supporting surface 21 of a tool block 20 taking advantage of a component of force which acts on the clamp d surfaces. This enables the holder to be held stably in xact position in th tool block.

Fig. 10A shows an arrangement for and Fig. 10B shows th results of a comparison test in which the insert holding power of the hold r of Fig. 7 was evaluated. As shown in the drawing, the holder 1 was drawn rearwardly with the insert 10 press-fit in the wedge groove 2 fixed in position. The minimum tensile force needed to cause a relative movement between the holder and the insert was measured as the insert holding power of the tool. The results show that the holding power of the tool increased about 30 per cent when the insert was coated with soft alloy A of nickel chrome family and about 70 per cent when the insert was coated with soft alloy B of copper family, compared with a cemented carbide insert not coated at all.

If the holder is made of cemented carbide, the wedge groove can be opened only slightly when the insert is press fit and the elastic recovery and thus the clamping force of the upper and lower jaws will decrease. But the insert can be more firmly held if it is coated with soft metal layers on its wedge surfaces since the soft metal layers can deform when the insert is press-fit, thus engaging the wedge surfaces on the wedge groove with an increased frictional force.

Now referring to Fig. 11 showing the eleventh embodiment, the wedge groove 2 has such a sectional shape that its back end face 7 which is free from contact with the throw away insert received in the wedge groove is curved with a radius R2 at a portion 7b connecting with the wedge surface 3 (which receives the main component of a cutting force) and with a radius R1 at a portion 7a connecting with the wedge surface 4 (which receives the backside component of the cutting force). R1 and R2 should be determined as follows :

$$R2 > R1$$
$$0.2 \leqq R1 \leqq 5$$
$$1 \leqq R2 \leqq 10$$

One problem with a conventional holder is that the stress during cutting tends to concentrate at the root of the wedge surface 3. With this embodiment, since the portion 7b where large part of the cutting stress tends to concentrate has a larger curvature R2 than R1 and further the R1 and R2 values are correlated to each other in an optimum way so that the cutting stress is distributed uniformly over a wider area. Thus, the maximum stress value is reduced. For example, R1 may be set to 1R and R2 set to 3.4R.

The stress values at the back end portion 7 of the wedge groove were measured by use of the finite-element method analysis. Fig. 15 shows the results of m asurement. Fiv specim ns which were numbered from 1 to 5 in th drawing were tested, among which Nos. 2 to 5 were holders having curvatur s which satisfy the conditions stipulated above. The drawing cl arly shows that with such holders the cutting

stress is less likely to concentrate on a limited area and thus th maximum stress valu is reduced.

Fig. 13 shows the results of cutting tests with specimens having different R1 and R2 values. The results reveal that the holders of this embodiment were less liable to break during cutting.

Next, referring to Fig. 14 showing the twelfth embodiment, wedge surfaces 3 and 4 on the upper and lower jaws of the holder are adapted to be in contact with wedge surfaces 13 and 14 on the insert 10 at contact portions 9, respectively.

The width $\underline{a}$ between the contact portions 9 shown in Fig. 16 should preferably be sufficiently wide to hold the insert in a stable and steady manner. Therefore, the angle of the V-shaped rib on the holder is usually slightly larger than the angle of the V-shaped groove in the insert so that the contact portions 9 will be located near the edges of the grooves and the ribs. But the inventor found that the wider the width $\underline{a}$, the more the holder tends to develop a crack C as shown in Fig. 16.

In the twelfth embodiment of Fig. 14, the angle θ_4 of the V-groove at the lower jaw and the angle θ_3 of the V-rib at the lower jaw should be set as follows :

$$3° \leqq \theta_4 - \theta_3 < 10°$$

Further, the width $\underline{a}$ between the contact portions 9 should be set against the width $\overline{W}$ of the cutting edge as follows :

$$0.1\overline{W} < \underline{a} < 0.4\overline{W}$$

The angle θ_4' of the V-groove at the upper jaw and the angle θ_3' of the V-rib at the upper jaw are not so limited as those at the lower jaw, but the following requirement should be met for more stable support:

$$\theta_3' > \theta_4'$$

The distribution of stress over the insert depends upon the value of $\underline{a}$. Figs. 17b to 17e show stress distribution patterns over the section of the insert 10 taken along line A-A' of Fig. 17a which was obtained in the finite-element method analysis (FEM analysis) when the material (S45C) is fed at a feed speed f = 0.4 mm/rev and machined with a 3 mm wide insert at a cutting speed V = 150 m/min (the main component of the stress is 300 kgs. then). The drawings show that as the value $\underline{a}$ (in mm) grows, the insert tends to be subjected to rather strong tensile stress along the centerline of the V-shaped groove as shown by full line arrows. It will be also seen from the drawings that as the value $\underline{a}$ gets smaller, the full line arrows tend to change to chain line arrows which represent compressive stresses. Cemented carbide which is the material of the throw away insert tends to be weaker to tensile stress than to compressive stress. Thus, it is necessary to set the value $\underline{a}$ below a certain extent to prevent the insert from breaking.

As can be seen from th r sults of th FEM analysis shown in Fig. 18, the difference of angle θ (= $\theta_4 - \theta_3$) between th angle θ_4 of the V-groove and the angle θ_3 of V-rib at the lower jaw of the holder should be set larger than a certain value. Otherwis , th insert may displace with respect to th hold r, thus causing the contact portions to move. If the $\underline{a}$ value should change during cutting, the stress distribution pattern on the insert will become unstable. This may cause the insert to be broken, as will be seen from the results of experiments described below.

Fig. 19 shows the results of the cutting experiments with inserts having different $\underline{a}$ and θ values. The results show that the optimum ranges of the $\underline{a}$ and θ values are $\underline{a} \leqq 0.4\overline{W}$ and $\theta \geqq 3°$.

Now referring to Fig. 15, a holder 1 of this embodiment is formed in its head portion with a wedge groove 2 formed with top and bottom wedge surfaces 4 and 3. The bottom wedge surface 3 is truncated to form a top flat surface 8. The holder gets into contact with an opposite groove wedge surface at the edge lines 19 of the surface 8.

Fig. 14 shows a sectional view of the embodiment of Fig. 15 in which the value $\underline{a}$ is wider than in Fig. 16 and θ_3, θ_4, θ_3', θ_4' and $\underline{a}$ meet the abovesaid requirements.

Contrary to the arrangement of this embodiment, the tool may have its wedge surface 3 grooved in V-shape while forming the wedge surface 13 on the insert in the form of V-ridge. Similarly, the tool may have its wedge surface 4 grooved in V-shape while the wedge surface 14 on the insert may be formed with a V-shape ridge.

Claims

1. A cutting tool having a holder body (1) formed with a wedge groove (2) and a throw away insert (10) having a cutting edge (11) at one end thereof and a wedge portion (12) at an end opposite to said cutting edge (11), said wedge portion (12) being adapted to be clampled in said wedge groove (2) by elasticity of the material of said holder (1) so that the principal component of the cutting force will be received on a first of two wedge surfaces (3, 4) of said wedge groove (2) and its backside component will be received on the second one, wherein the wedge angle (θ_2) between said wedge surfaces (3, 4) is in the range of 6° to 14°, and said wedge groove (2) has a curved back end face out of contact with said throw away insert (10) received therein and wherein one of said wedge grooves (2) of said holder (1) or of said wedge portion (12) of said throw away insert (10) has its w dge surface relating to th principal component formed with an axial ridge in V-shape whereas the other has its wedge surface relating to the principal compon nt formed with an axial groov in V-shap ,

characteriz d in
that said holder body is made of cement d carbid in its ntir part,
that said back end surface is curved with a radius R1 at a portion connected with said second wedge surface (4) of said wedge groove (2) and with a radius R2 at a portion connected with said first wedge surface (3), wherein R2 is greater than R1,
and that said ridge having its top cut away so as to contact said axial, V-shaped groove along parallel lines which are apart from each other by a distance a, said distance a being determined by

$$a \leqq 0.4\overline{W},$$

wherein $\overline{W}$ is the width of the cutting edge of said insert (10).

2. A cutting tool as claimed in claim 1,
wherein said holder (1) has its top and bottom surfaces (5) to be gripped by a clamp covered with a steel layer.

3. A cutting tool as claimed in claim 1,
wherein said wedge groove (2) has its wedge surfaces made of a material harder than the material of said holder body (1).

4. A cutting tool as claimed in claim 1,
characterized in
that the wedge angle (θ_1) of the lower wedge surface of said wedge groove (2) with respect to the horizontal plane is in the range of 0° - 5°.

5. A cutting tool as claimed in claim 1,
characterized in
that said radii R1 and R2 being further determined as

$$0.2 \leqq R1 \leqq 5$$
$$1 \leqq R2 \leqq 10.$$

6. A cutting tool as claimed in claim 1,
characterized in
that said groove and ridge at the lower side of said wedge groove having angles of θ_4 and θ_3, respectively, which is determined as

$$3° \leqq \theta_4 - \theta_3.$$

7. A cutting tool as claimed in claim 6,
wherein said angles of θ_3 and θ_4 and said distance a are set as follows :

$$3° < \theta_4 - \theta_3 < 10°$$
$$0.1\overline{W} < a < 0.4\overline{W}$$

8. A cutting tool as claimed in claim 6 or 7, wherein the groov and ridge at th upper side of said wedge groove hav angles of θ_4' and θ_3', respectively, which are determined as

$$\theta_4' < \theta_3'.$$

Patentansprüch

1. Schneidwerkzeug mit einem Haltekörper (1), der mit einer Keilnut und einem Wegwerfeinsatz (10) versehen ist, der an einem Ende eine Schneidkante (11) und am gegenüberliegenden Ende einen Keilabschnitt (12) aufweist, wobei der Keilabschnitt (12) infolge der Elastizität des Materials des Halters (1) in die Keilnut (2) geklemmt werden kann, so daß die Hauptkomponente der Schneidkraft an einer ersten der beiden Keilflächen (3,4) der Keilnut (2) und ihre rückseitige Komponente an der zweiten Keilfläche aufgenommen wird, wobei der Keilwinkel (θ_2) zwischen den Keilflächen (3,4) im Bereich von 6° bis 14° liegt und die Keilnut (2) eine gekrümmte, hintere Endfläche hat, die mit dem darin aufgenommenen Wegwerfeinsatz nicht in Berührung steht, und entweder die Keilnut (2) des Halters (1) oder der Keilabschnitt (12) des Wegwerfeinsatzes (10) eine auf die Hauptkomponente bezogene Keilfläche aufweist, die mit einer axialen Rippe in V-Form versehen ist, während die jeweils andere auf die Hauptkomponente bezogene Keilfläche mit einer axialen Nut in V-Form versehen ist,
dadurch **gekennzeichnet**, daß der Haltekörper (1) vollständig aus Sinterkarbid hergestellt ist, daß die hintere Endfläche an einem Abschnitt, der sich an die zweite Keilfläche (4) der Keilnut (2) anschließt, mit einem Radius R1 gekrümmt ist und an einem Abschnitt, der sich an die erste Keilfläche (3) anschließt, mit einem Radius R2, der größer als der Radius R1 ist, gekrümmt ist, und daß die Rippe an ihrer Oberseite so abgeschnitten ist, daß sie die axiale V-förmige Nut entlang paralleler, im Abstand von a zueinander liegender Linien berührt, wobei der Abstand a bestimmt ist durch

$$a \leqq 0{,}4\overline{W},$$

mit $\overline{W}$ gleich der Breite der Schneidkante des Einsatzes (10).

2. Schneidwerkzeug nach Anspruch 1, wobei der Halter (1) an seinen oberen und unteren Flächen (5) von einem mit Stahl beschichteten Einspannkopf ergreifbar ist.

3. Schneidwerkzeug nach Anspruch 1, wobei die Keilflächen der Keilnut (2) aus einem Material hergestellt sind, das härter als das Material des Haltekörpers (1) ist.

4. Schneidwerkzeug nach Anspruch 1, dadurch **gek nnzeichn t**, daß di untere Keilfläche der Keilnut (2) zur Horizontal bene einen Keilwinkel (θ_1) im Bereich von 0°-5° hat.

5. Schneidw rkzeug nach Anspruch 1, dadurch **ge-**

k nnz i hn t, daß di Radien R1 und R2 weiterhin bestimmt sind durch

$$0{,}2 \leqq R1 \leqq 5$$
$$1 \leqq R2 \leqq 10.$$

6. Schneidwerkzeug nach Anspruch 1, dadurch **gekennzeichnet**, daß Nut und Rippe an der Unterseite der Keilnut jeweils Winkel θ_4 bzw. θ_3 aufweisen, wobei bestimmt ist, daß
$$3° \leqq \theta_4 - \theta_3.$$

7. Schneidwerkzeug nach Anspruch 6, wobei die Winkel θ_3 und θ_4 und der Abstand a wie folgt bestimmt sind:
$$3° < \theta_4 - \theta_3 < 10°$$
$$0{,}1W < a < 0{,}4W$$

8. Schneidwerkzeug nach Anspruch 6 oder 7, wobei die Nut und Rippe an der Oberseite der Keilnut jeweils Winkel θ_4' bzw. θ_3' aufweisen, die bestimmt sind durch:
$$\theta_4' < \theta_3'.$$

Revendications

1. Outil à tronçonner ayant un corps de porte-outil (1) avec une rainure en forme de coin (2) et un insert à jeter (10) ayant une arête de coupe (11) à une extrémité de celui-ci et une partie de coin (12) à une extrémité opposée à ladite arête de coupe (11), ladite partie de coin (12) étant conçue pour être serrée dans ladite rainure en forme de coin (2) par l'élasticité du matériau dudit porte-outil (1), si bien que la composante principale de la force de coupe est reprise sur une première des deux surfaces de coin (3, 4) de ladite rainure en forme de coin (2) et que l'autre composante est reprise sur la deuxième surface, dans lequel l'angle de coin (θ_2) entre lesdites surfaces de coin (3, 4) est compris entre 6° et 14°, et dans lequel ladite rainure en forme de coin (2) a une face arrière incurvée non en contact avec ledit insert à jeter (10) qui y est placé et dans lequel soit la rainure en forme de coin (2) du porte-outil (1), soit la partie de coin (12) de l'insert à jeter (10) présente une surface de coin reprenant la composante principale pourvue d'une crête axiale en forme de V, tandis que l'autre élément a sa surface de coin reprenant la composante principale pourvue d'une rainure axiale en forme de V, caractérisé en ce que ledit porte-outil est entièrement réalisé en carbure cémenté, en ce que ladite surface arrière présente une courb avec un rayon R1 dans une partie raccordée à ladite deuxième surface de coin (4) de la rainure en forme de coin (2), et avec un rayon R2 dans une partie raccordé à ladite première surfac de coin (3), dans lequel R2 est supérieur à R1, et en ce qu la crêt a son sommet enlevé de façon à venir en contact avec ladite rainure axiale en forme de V suivant des lign s parallèles écartées l'une de l'autre d'une distance a, ladite distance a étant déterminée par la relation suivante :
$$a \leqq 0{,}4\,\overline{W},$$
dans lequel $\overline{W}$ est la largeur de l'arête de coupe dudit insert (10).

2. Outil à tronçonner selon la revendication 1, dans lequel ledit porte-outil (1) a ses surfaces supérieure et inférieure (5) saisies par un moyen de serrage recouvert d'une couche d'acier.

3. Outil à tronçonner selon la revendication 1, dans lequel ladite rainure en forme de coin (2) a ses surfaces de coin réalisées en un matériau plus dur que le matériau dudit corps de porte-outil (1).

4. Outil à tronçonner selon la revendication 1, caractérisé en ce que l'angle de coin (θ_1) de la surface de coin inférieure de ladite rainure en forme de coin (2) a un angle par rapport au plan horizontal compris entre 0 et 5°.

5. Outil à tronçonner selon la revendication 1, caractérisé en ce que lesdits rayons R1 et R2 sont déterminés en outre par les relations suivantes :
$$0{,}2 \leqq R1 \leqq 5$$
$$1 \leqq R2 \leqq 10.$$

6. Outil à tronçonner selon la revendication 1, caractérisé en ce que ladite rainure et ladite crête sur la face inférieure de ladite rainure en forme de coin ont des angles θ_4 et θ_3 respectivement qui sont déterminés par la relation
$$3° \leqq \theta_4 - \theta_3.$$

7. Outil à tronçonner selon la revendication 6, dans lequel lesdits angles θ_3 et θ_4 et ladite distance a sont définis par les relations :
$$3° < \theta_4 - \theta_3 < 10°$$
$$0{,}1\,\overline{W} < a < 0{,}4\,\overline{W}$$

8. Outil à tronçonner selon la revendication 6 ou 7, dans lequel la rainure et la crête à la face supérieure de ladite rainure en forme de coin ont des angles θ'_4 et θ'_3 respectivement, déterminés par la relation
$$\theta'_4 < \theta'_3.$$

FIG. 1

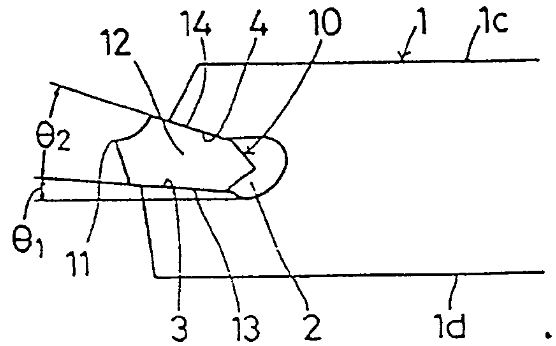


FIG. 2

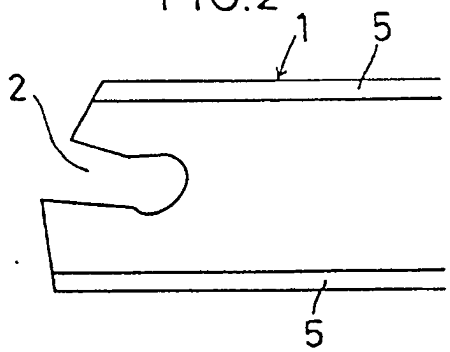


FIG. 3

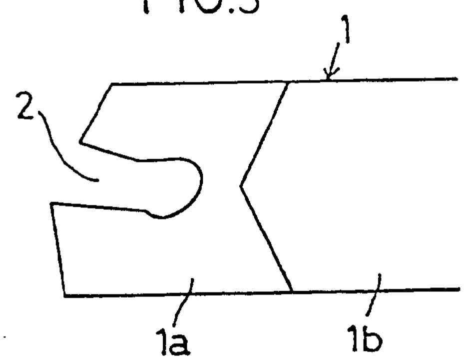


FIG. 4

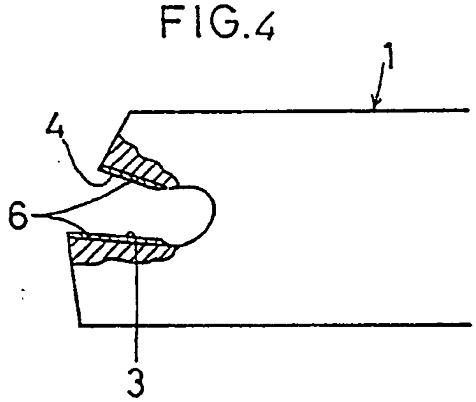


FIG. 5

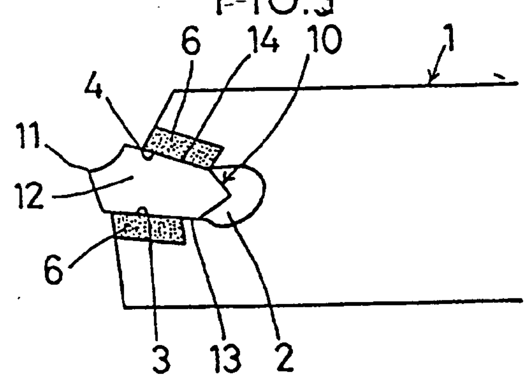


FIG.6

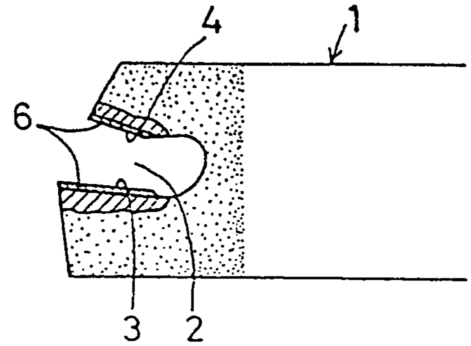


FIG.7

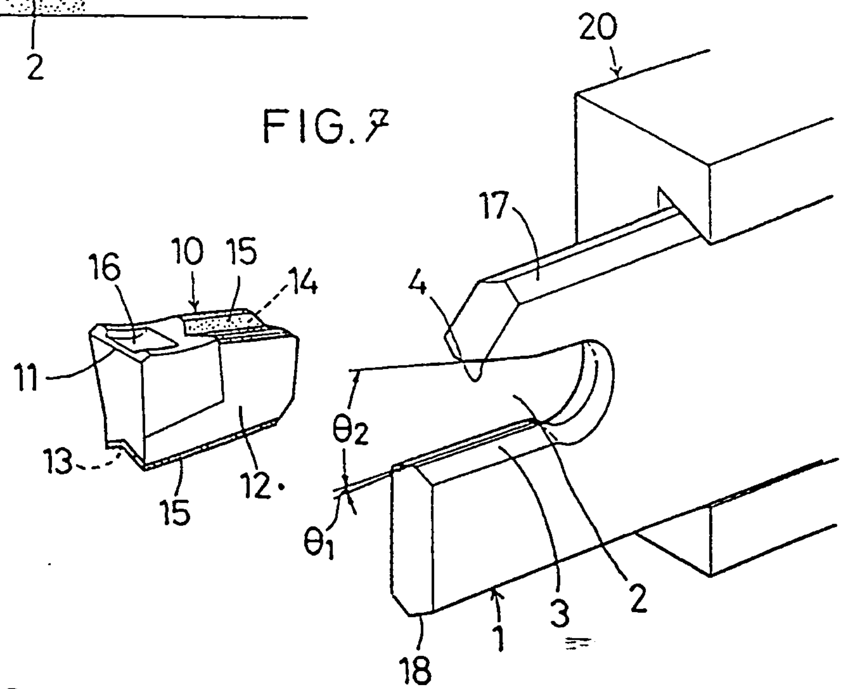


FIG.8

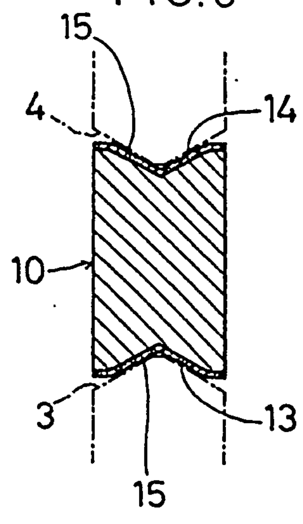


FIG.9

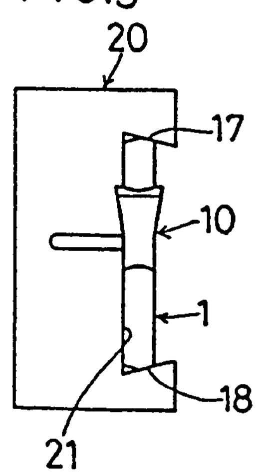


FIG.10A

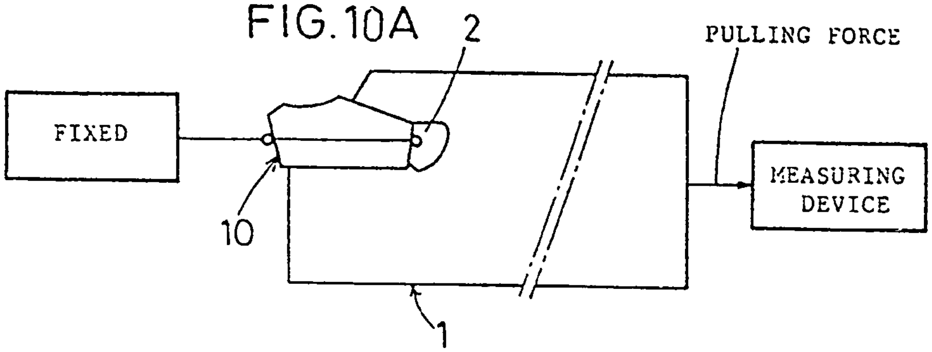


FIG.10B

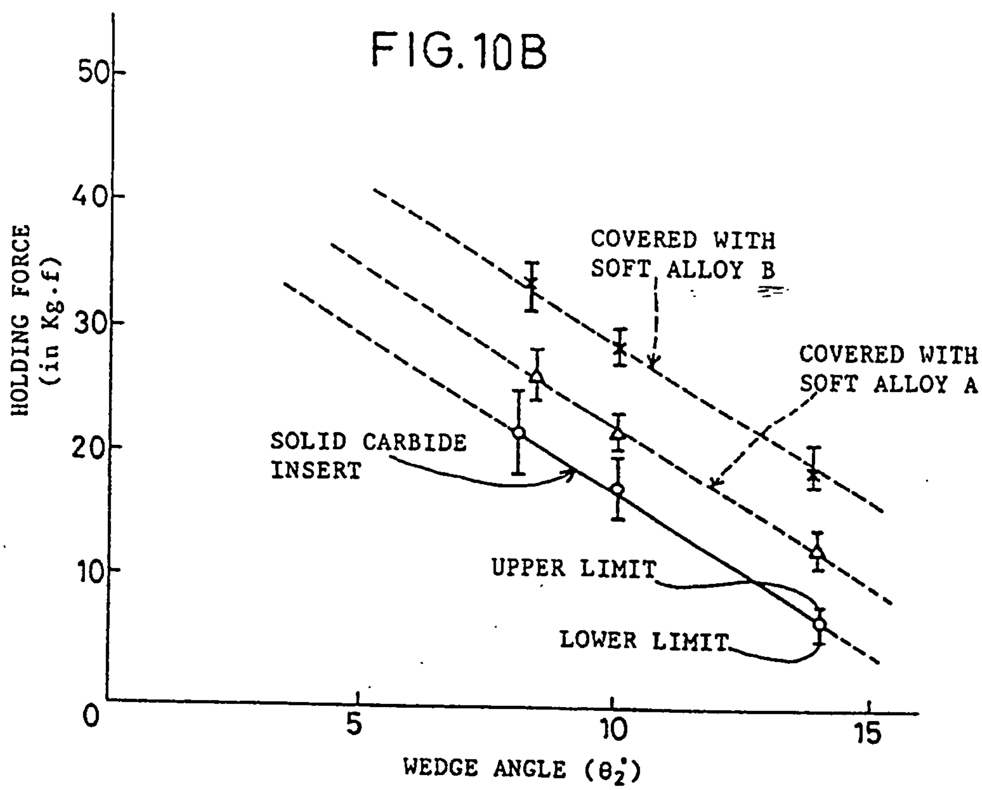
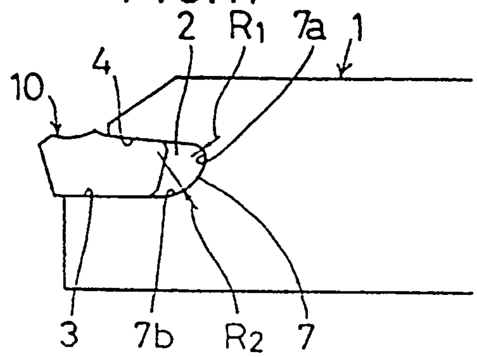
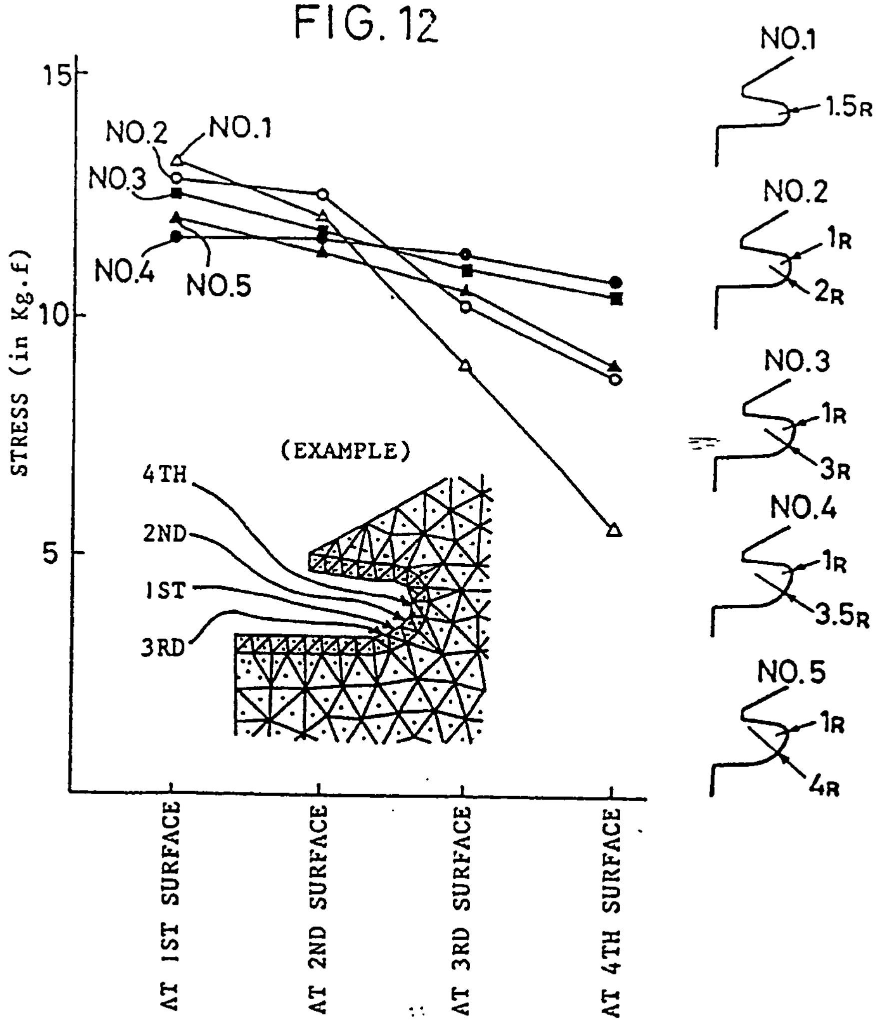


FIG.11



10
4
2
R1
7a
1
3
7b
R2
7

FIG.12



15
10
5
STRESS (in Kg.f)
NO.1
NO.2
NO.3
NO.4
NO.5
(EXAMPLE)
4TH
2ND
1ST
3RD
AT 1ST SURFACE
AT 2ND SURFACE
AT 3RD SURFACE
AT 4TH SURFACE
NO.1
1.5R
NO.2
1R
2R
NO.3
1R
3R
NO.4
1R
3.5R
NO.5
1R
4R

FIG.13

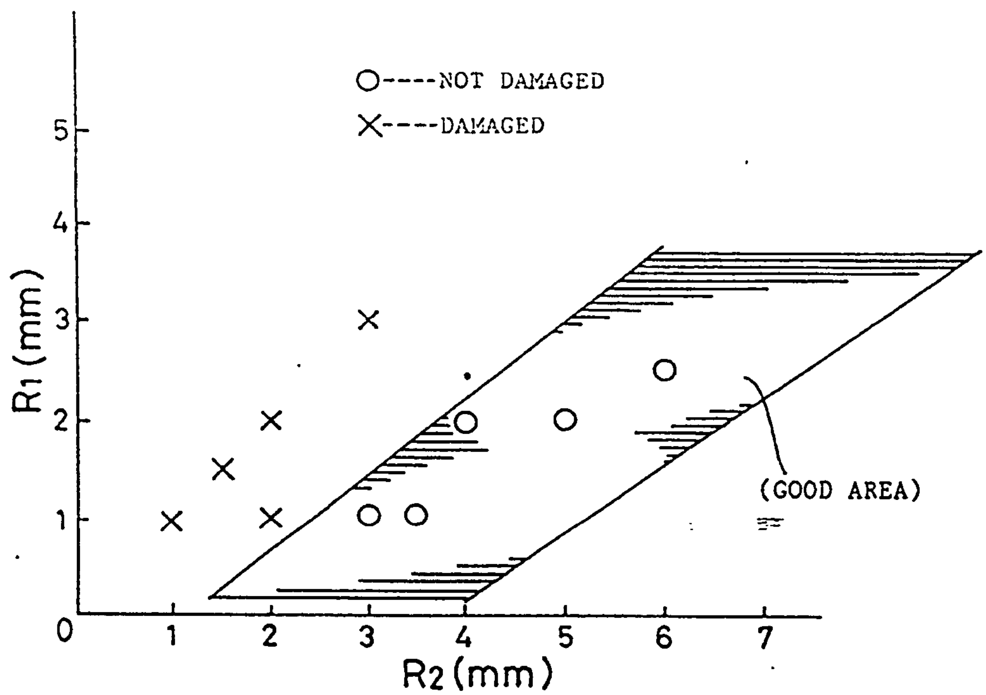


FIG. 14

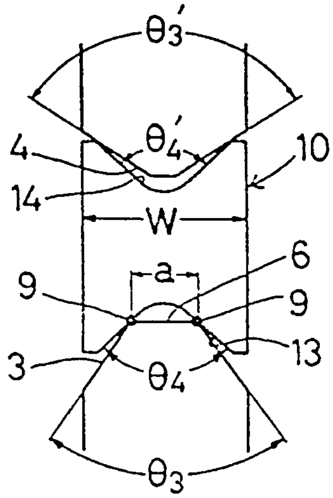


FIG. 15

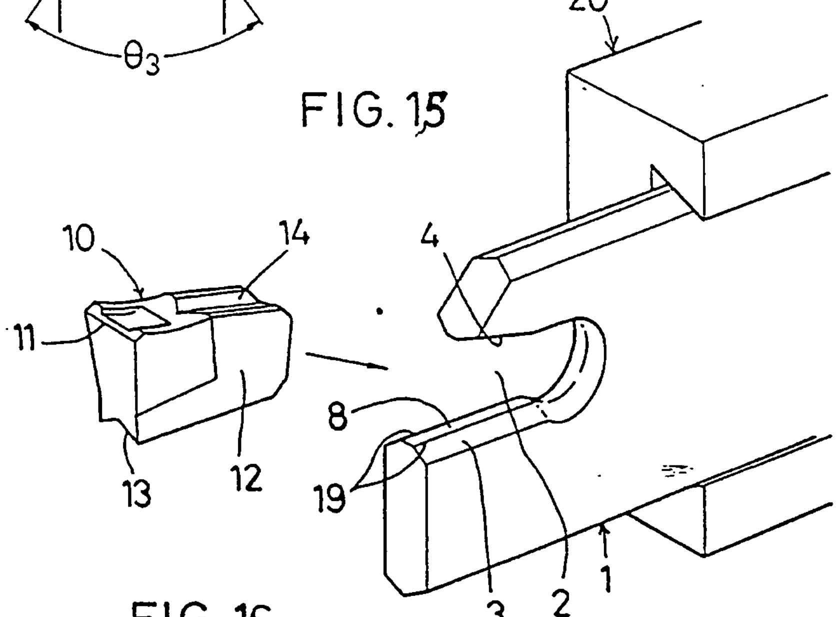


FIG. 16

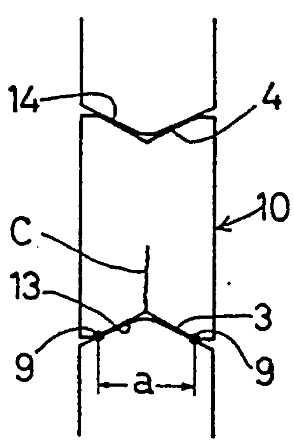


FIG.17 A

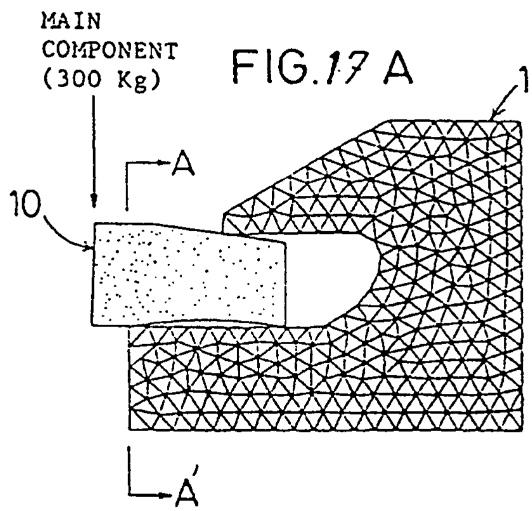


FIG.17 B

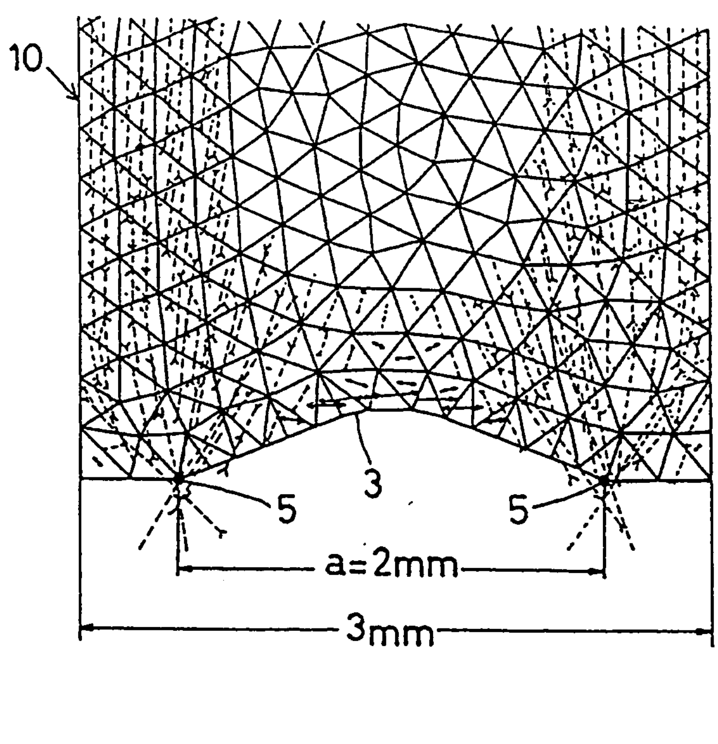


FIG. 17 C

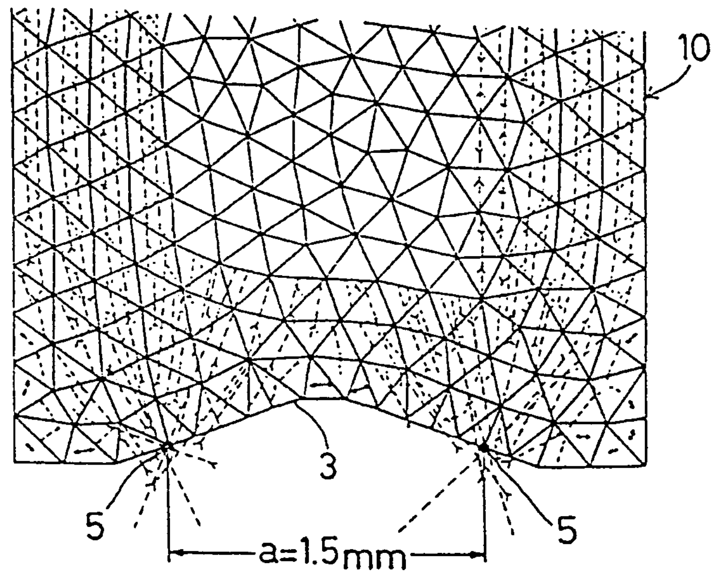


FIG. 17 D

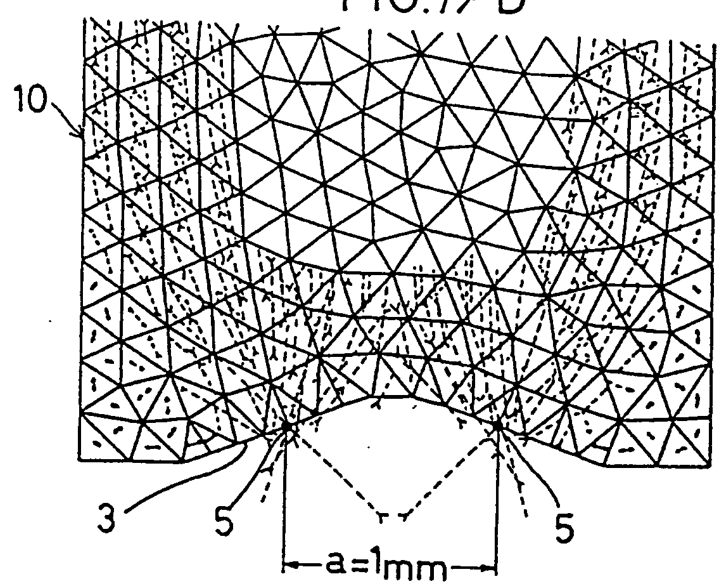


FIG.17 E

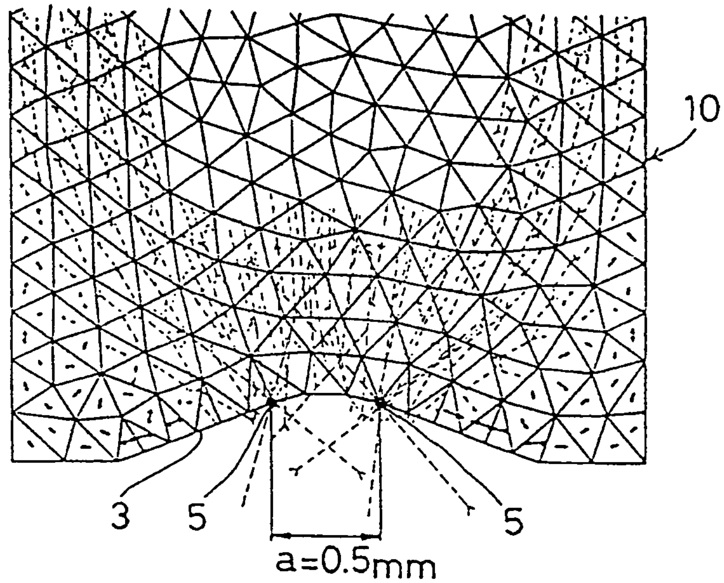


FIG.18

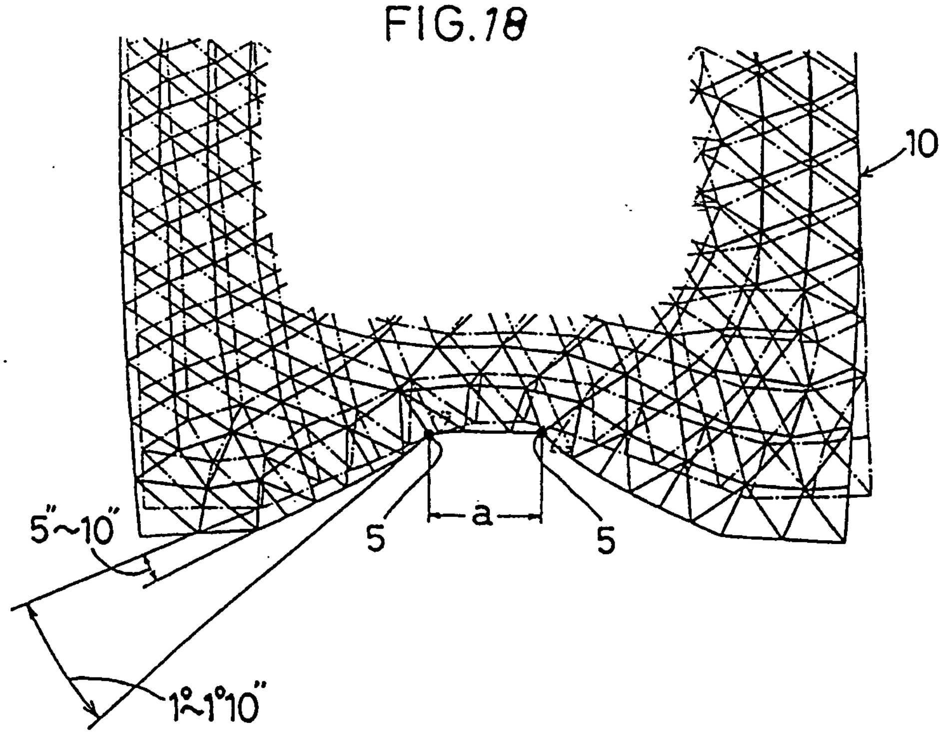
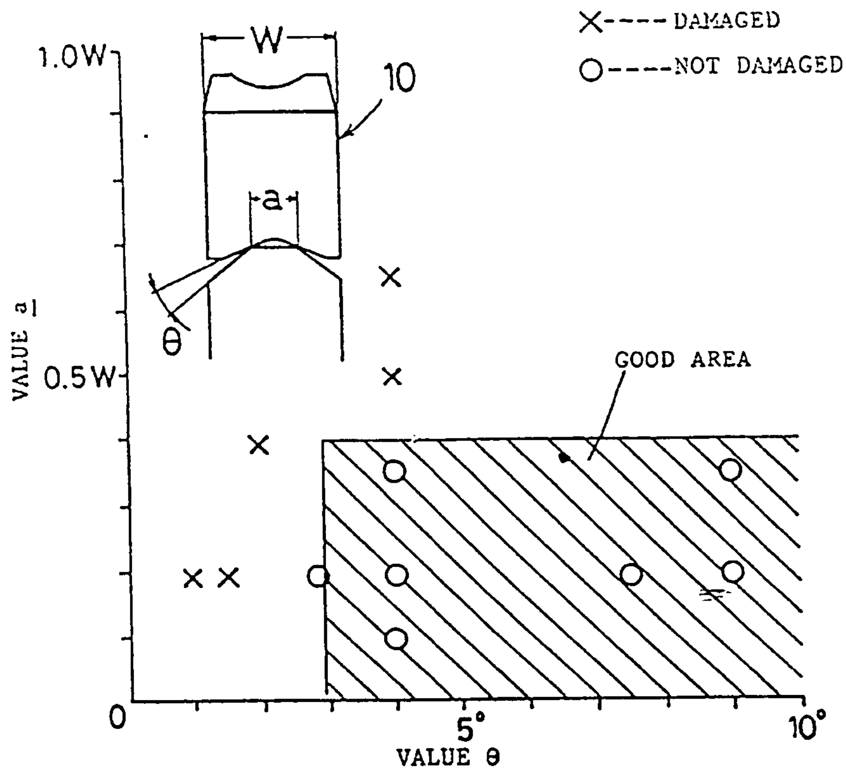


FIG.19



×----DAMAGED
○----NOT DAMAGED
W
10
a
θ
1.0W
0.5W
0
VALUE a
GOOD AREA
5°
10°
VALUE θ